FEDERATED MALAY STATES.

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OF THE

DEPARTMENT OF AGRICULTURE.

S.S. AND F.M.S.,

FOR THE YEAR

1930

BY

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FEDERATED MALAY STATES.

ANNUAL REPORT OF THE DEPARTMENT OF AGRICULTURE, STRAITS SETTLEMENTS AND FEDERATED MALAY STATES, FOR THE YEAR 1930.

Part I.

AGRICULTURE IN MALAYA IN 1930.

WEATHER CONDITIONS IN 1930.

Practically throughout the Peninsula, climatic conditions were characterised by two well-marked periods of unusually hot dry weather. In the western side of the Peninsula the first period extended from the beginning of January to the end of March and thus followed directly on the dry December of the preceding year. On the east of the main range, the month of January was wet and the dry weather did not commence until February, while on the east coast of Pahang, March was also a wet month.

The first dry period was succeeded by wet weather and heavy rainstorms during April-May and part of June, local floods being experienced in Southern Perak in June.

The second dry period commenced in June and lasted until the end of August, being somewhat earlier in some districts and later in others.

This was followed by the normal rainfall of the north-east monsoon during the last quarter of the year, though in Central and Eastern Pahang at the end of the year the rainfall was sufficiently heavy to cause serious flooding of the Pahang River.

As a result, more especially, of the first dry period the rainfall of 1930 in comparison with the average was deficient, every district, with the exception of North Perak and the strip of the west coast between Klang and Malacca, having broadly speaking about 20 inches less rainfall than is normal. The first dry spell did not affect Perak, particularly North Perak, to the same extent as other districts, while on the coastal strip already mentioned the rainfall was nearly normal.

Day temperatures ranged from an average of 91.3°F. to 86.2°F. with maximum temperatures during the first dry spell of 98°F. in some places and a minimum on the east coast during the north-east monsoon of 75°F. Night temperatures were uniform, the average for any month being usually, between 71 and 75°F. The lowest night temperature in the plains was 67°F. at Kuala Lumpur. In the uplands the highest temperature recorded at Fraser's Hill was 81°F. and Cameron's Highlands 77°F., while the coolest night was 58°F. at the former and 46°F. at the latter station.

CROP CONDITIONS.

The Rubber Industry.

The total area under rubber in Malaya at the end of 1930 was estimated to be 2,937,670 acres made up as follows :

	Acres.		
Federated Malay States—			
Perak	525,707		
Selangor	483,303		
Negri Sembilan	337,018		
Pahang	129,928		
		1,475,956	
Straits Settlements—			
Singapore	50,174		
Province Wellesley	63,481		
Penang	12,984		
Malacca	198,888		
Dindings	14,890		
		340,417	
Unfederated Malay States—			
Johore	705,298		
Kedah	289,942		
Kelantan	73,066		
Trengganu	47,991		
Perlis	5,000		
		1,121,297	
			2,937,670 acres.

The production is estimated to be as follows:

On estates over 100 acres—

Federated Malay States—

	Tons.		
Perak	44,617		
Selangor	52,000		
Negri Sembilan	38,432		
Pahang	5,740		
		140,789	
Straits Settlements—			
Singapore	2,657		
Penang	123		
Province Wellesley	5,693		
Malacca	14,827		
Dindings	1,175		
		24,475	
Unfederated Malay States—			
Johore	42,758		
Kedah	24,210		
Kelantan	3,114		
Trengganu	1,333		
Perlis	96		
		71,511	
			236,775 tons.

Production figures on small holdings for each of the individual States are not available, but for each administration group, they are estimated to be as follows:

	Tons.	
Federated Malay States	110,206	
Straits Settlements	38,770	approx.
Unfederated Malay States	66,113	
	215,089	

The estimated total production of rubber for Malaya is therefore as under:

	Tons.
Federated Malay States	250,995
Straits Settlements	63,245
Unfederated Malay States	137,624
	451,864

For comparison the net export figures for the three previous years are given:

	Rubber, tons.	Latex, gallons.
1927	188,456 ...	1,560,976
1928	258,906 ...	919,909
1929	415,608 ...	1,708,529

Similar data for rubber for the Netherlands East Indies and for Ceylon are shewn below for comparison:

	N.E. Indies. Tons.	Ceylon. Tons.
1928	226,000 ...	56,000
1929	259,000 ...	80,500
1930	270,000 ...	75,000

The estimated area of new plantings of rubber is as follows:

Federated Malay States—

	Acres.
Perak	6,273
Selangor	2,869
Negri Sembilan	5,829
Pahang	3,803
	18,774

Straits Settlements—

	Acres.
Singapore	7
Penang	50
Province Wellesley	212
Malacca	1,060
Dindings	90
	1,419

Unfederated Malay States—

Figures not yet available.

During the year it was decided to suspend further alienation of land for rubber planting throughout Malaya and since September, 1930, no fresh alienations have been made, consequently additions to the planted areas so far as is known have since that date only occurred on land previously alienated.

Economic Conditions of the Rubber Industry.—The sale price of rubber during 1930 fell to the lowest figure in the history of the industry. The average Singapore price of first grade smoked sheet during the four quarters of the year was as under:

First quarter	25 cents per lb.
Second ,, ...	22¼ ,, ,,
Third ,, ...	15½ ,, ,,
Fourth ,, ...	13¼ ,, ,,

In an attempt to reduce stocks and so improve the price a "tapping holiday" was agreed upon during the month of May. This was very generally observed by the owners of big estates (i.e., those of 100 acres or over), with the result that the crop harvested in the Federated Malay States in May on such estates was only 1,688 tons as compared with 11,137 tons harvested in April. The smaller holdings did not observe this holiday and it is agreed that its effect upon the sale price of rubber was negligible.

Later in the year official conversations between the Governor of the Netherlands East Indies and the High Commissioner for the Federated Malay States were arranged. During these the question of the possibility of imposing some form of restriction of output or export to be enforced by the Governments concerned was discussed. It was later announced that no official steps to restrict the export or production of rubber were contemplated.

Towards the end of the year a number of estates and of the poorer small holdings had ceased tapping wholly or in part, and it is estimated that at the end of the year the area out of tapping in the Federated Malay States and Straits Settlements, respectively, was as follows:

Federated Malay States	133,213
Straits Settlements	32,373

CONDITIONS ON ESTATES.—Throughout Malaya the larger estates on the whole maintained the normal standard of upkeep throughout the year, but especially during the later months some curtailment of fieldwork became inevitable as the result of the low price of rubber; staffs and labour forces were curtailed, salaries and labourers' wages were reduced, and tasks were increased with the sanction of the Labour Department, while a considerable number of Indian labourers had been repatriated up to the end of the year; so far as is known no estates had been abandoned, but a continuation of existing conditions must inevitably lead to the elimination of the weaker units.

Considerable economies in production have been effected and many estates have found it possible to reduce their f.o.b. cost of production to 10-12 cents per lb. Straits currency, a figure which, however, leaves little or no margin for profits and allows nothing for improvements.

Continued attention has been given by estates to the planting of high yielding clones of budded rubber. During the year importation of budwood from the Netherlands East Indies was continued but the quantity imported was less than in 1929, a result partly due to financial reasons, and partly to the increasing production of budwood from estates' multiplication nurseries.

The total area of budded rubber in the Straits Settlements and Federated Malay States at the present time is estimated to be 73,500 acres. It is known that large areas in Kedah and Johore have been budgrafted: figures will be published later. Several new clones of great promise have also been discovered and records of them are now being kept by the Rubber Research Institute.

Records of high yielding mother trees on a number of estates have been continued and buddings of some of them have already been made at the Rubber Research Institute Experiment Station. It is anticipated that a number of valuable Malayan clones will be derived from these trees.

Numerous enquiries dealing with the technique of budding have been received by the Rubber Research Institute and dealt with, while advice is being freely sought by and given to estates on the suitability of the best known clones and their establishment either as pure clones in blocks or as mixed plantings.

Many estates are also now prepared to plant blocks of single clones which have a sufficiently long record of tapping and which have not developed any defects.

In view of the fact that most planters are now convinced of the value of budding, interest has also been taken in the high budding of 2½ to 4-year old stock and small areas have been budded at 18 inches and higher.

Interest in questions of soil management and systems of soil conservation has continued to extend; present practice on the whole favours silt pitting and bunding combined with clean weeding as the most satisfactory system, as against the establishment of cover crops and the question has been raised as to whether the establishment of heavy covers does not tend to diminish latex yields. The question is under investigation.

Interest in manuring has also tended to expand. The successful results obtained in Sumatra in raising latex yields by manuring have stimulated activity in this direction, and many estates have now embarked upon experimental programmes of manuring. It is now generally recognised that the problem of manuring rubber is a specialised one differing from that of the majority of other crops, inasmuch as the amount of plant food removed by the crop is practically negligible, and manuring is required rather as a stimulant to growth and as a means of replacing losses which have occurred in the past owing to defective soil management than as a consequence of continued cropping.

Continued investigation has shown the value of applying nitrogenous fertilisers on a number of estates, while on others evidence has accumulated which indicates that response to potash fertilisers is obtained.

An important fact to bear in mind is that in the first instance, attention should be paid to medium yielding areas and areas which show initial signs of deterioration. Some very bad areas cannot be treated economically, while on some estates, increased yields due to manuring will be delayed till the vegetative characters of the trees—especially foliage and bark renewal—have been improved.

In view of the availability of high yielding planting material, interest is being taken in rejuvenation and replanting of old rubber areas, which show signs of marked decrease in yield or on which root disease is becoming the limiting factor in the life of the trees or the yield of latex.

Investigations in relation to estate factory practice have demonstrated the possibility of increasing the output of sheet rubber by the use of wide roll light machines and deep coagulating tanks.

On several estates an output equivalent to 1,200-1,300 lbs. of dry rubber per hour has been obtained with a light battery of three smooth roll and one marking machine compared with an average output of 400-500 lbs. per hour obtained in the best factories.

The handling of the coagulum from the coagulating tanks without preliminary hand rolling has been effected by means of suitable aluminium chutes.

An investigation of latex has resulted in the isolation of a lipin body which appears not only to be of importance in relation to rate of vulcanisation but to be closely related to the important variability in plasticity of plantation rubber.

Investigations on the presence of fine sand in latex and sheet rubber have demonstrated the importance of preliminary settling of latex and careful straining in "box" or similar strainers with vertical sieves.

A feature of the year has been the large number of enquiries for advice and assistance received by the Rubber Research Institute in respect of various defects in raw rubber.

Small Holdings.—Increasing interest has continued to centre on the production of rubber from small holdings. Data collected by the Statistical Division of the Department of Agriculture place the production on small holdings for the two years 1929-1930 at the following figures:

	1929.	1930.
Federated Malay States	110,282 tons	... 110,206 tons
Straits Settlements	—	... 38,770 ,, approx.
Unfederated Malay States ...	—	... 66,113 ,,

It will thus be seen that the production from small holdings as yet shows no sign of diminishing. Considerable attention has been given to the question of bark consumption on small holdings and proposals put forward for undertaking a regular survey in this respect. Preliminary observations conducted during the year appear to indicate that in the effort to obtain as large a yield as possible the rate of consumption on small holdings may be considerably outstripping the rate of bark renewal.

There is no question that many small holdings have been severely tapped, while the general upkeep has to some extent deteriorated. In places a certain number of the poorer holdings have remained untapped for a number of months; on others tapping has only been discontinued temporarily during adverse weather conditions, during padi planting or harvesting operations, or during a period when the price of rubber was at its lowest.

Some owners of small holdings have dismissed their tappers and undertaken the work themselves. Many more have re-introduced the pernicious produce sharing system whereby the tapper receives as pay the larger share of the rubber obtained and, in consequence, extracts every ounce he can, regardless of damage to the trees. Where wages have been paid the rate given has perforce been the lowest possible.

Pests and Diseases of the Rubber Tree.—The most notable feature of the year was a severe outbreak of mildew disease of the leaf caused by the fungus *Oidium Heveae* in certain areas in South Negri Sembilan and Malacca.

This is attributed to the prolonged drought after the normal dry period during the wintering season in February-March. The trees, however, made a good recovery after the secondary leaf fall, which followed the normal leaf fall during February-March.

The fungus was identified in a number of districts later in the year and steps have been taken to deal with the situation if an outbreak occurs during 1931. An important observation is the fact that the fungus appears to be carried over from one season to another on the inflorescences of the tree.

As a result of the outbreak and the investigations conducted, the disease has been declared a Notifiable Disease under the Pests and Diseases Enactment and Ordinance in the Federated Malay States and Straits Settlements respectively.

Two sulphur dusters have also been purchased by the Rubber Research Institute for experimental work while close touch is being maintained with the control work being carried out in Java and Ceylon where the disease has been epidemic in character.

Although it is thought that the climatic conditions generally in Malaya are unfavourable to the outbreak and spread of this disease, this cannot be definitely stated at present, since the trees may become less immune to attacks.

An investigation of the incidence of root diseases—especially *Fomes pseudoferreus* and *Ustulina zonata* in rubber of different age classes—has been continued.

The importance of these diseases to the life of rubber estates is being realised on estates and control measures are becoming increasingly practised.

Somewhat severe outbreaks of Mouldy Rot occurred especially on small holdings during the wet season at the end of the year; measures to deal with this were undertaken.

Arrangements are being made for the investigation of proprietary and other fungicides for the treatment of this disease, since it has been realised that the present position is not altogether satisfactory.

No other fungus diseases call for special comment.

Damage by squirrels has been particularly noted on a few estates, not only on branches but also on the soft renewing bark on the tapping panel.

Scale insects (*Lecanium* species and *Pulvinaria* species) have also caused damage on two estates, chiefly owing to non-attention in the early stages.

An investigation carried out by the Pathological Division of the Rubber Research Institute has demonstrated the value of an asphalt cum kerosene or solar oil mixture as a wound cover or for application on pruned surfaces in budding and other operations.

Research Facilities.—Research work in relation to the rubber industry was continued by the Rubber Research Institute, the activities of which have been maintained at the full strength in spite of slump conditions. Appreciation of the work of the Institute is widespread in planting circles. Close liaison has been maintained by the Institute with the Department of Agriculture and the Department of Co-operation, the former covering all disease control work and propaganda among small holdings and the latter undertaking work in relation to improvement of manufacturing and marketing methods among small holders.

The Coconut Industry.

During 1930 a census of the area under coconuts was conducted by the Department of Agriculture in connection with the World's Agricultural Census, the total areas in the various States and Settlements being shown below:

	Acres.	Acres.
Federated Malay States—		
Perak	108,940	
Selangor	110,294	
Negri Sembilan	5,966	
Pahang	14,530	
		239,730
Straits Settlements—		
Singapore	8,000	
Malacca	12,585	
Dindings	6,530	
Province Wellesley	36,821	
Penang	13,526	
Labuan	3,196	
Brunei	1,370	
Christmas Island	19	
		82,047
Unfederated Malay States—		
Johore	165,050	
Kedah	26,688	
Perlis	3,961	
Kelantan	57,271	
Trengganu	25,000	
		277,970
Total ...		599,747

The net exports of coconut products are shown below:

Copra	102,330 tons	valued at	$15,334,949
Coconut oil	9,442 ,,	,,	2,350,007

Figures for total production are not available owing to the fact that there is a not inconsiderable utilisation of coconut products locally. The number of factories handling coconut products in Malaya is as follows:

Singapore	1
Selangor	2
Penang	3
Province Wellesley	1
Total ...	7

The Singapore price of Fair Merchantable quality copra declined steadily from $8.98 per picul in June to $5.66 per picul in December.

The average price of this quality was $7.45 per picul and of the sundried quality $7.80 per picul, as compared with $9.09 and $9.55, respectively, in 1929.

Experiments following a standard pattern have been laid down on five coconut estates, with a view to ascertaining the manurial requirements of this palm on different types of soil. Selection, manuring and cultivation experiments have been continued at the Experiment Station, Klang, and on Carey Island.

With the financial assistance of the Empire Marketing Board, investigations on improved methods of preparing copra were continued, a chemist being specially appointed for this purpose. Good progress has been made and some preliminary results have been published.

It has been shown that for the production of copra of uniform quality a uniform standard of ripeness when harvesting is essential, the evil effects of storing copra containing 8 per cent. or more of moisture have been demonstrated, and the effect of mould attacks on copra has been studied. Moulds have been found to exercise a selective action, and to cause a destruction of organic tissues rather than oil thus giving rise to an increase in the percentage oil content.

Control of the nettle caterpillar (*Setora nitens*) and of the Rhinoceros beetle (*Oryctes rhinoceros*) continued to call for and to receive attention. Sporadic outbreaks of the leaf-eating caterpillars (*Artona catoxantha*) also occurred but were controlled by the insect enemies of this pest. Investigations of the economic importance and control of the greater coconut spike moth (*Tirathaba rufivena*) were concluded and indicated that the damage caused by this insect is hardly of sufficient importance to justify the use of the simple method of control evolved.

During the year the question of the provision of improved research facilities for the coconut industry was discussed with planters. There seems reason to believe that the ultimate provision of a separate research organisation for this crop supported wholly or in part by the industry is desirable and it is hoped that when market conditions improve somewhat it may be possible to pursue the subject further.

Padi.

1929-1930 Season.—The approximate area planted with wet padi was 623,470 acres and that planted with dry padi 27,550. The distribution of this acreage and the yields obtained were as follows:

	Wet.		Dry.	
	Acreage.	Yield, gantangs.	Acreage.	Yield, gantangs.
Federated Malay States ...	156,989	35,330,934	13,048	1,683,109
Straits Settlements ...	64,825	17,208,910	352	70,400
Unfederated Malay States	401,656	51,084,535	14,150	1,406,392
	623,470	103,624,379	27,550	3,159,901

While recent investigations have considerably increased the accuracy of the acreage figures in the Federated Malay States, the Colony, Johore, Kedah and Perlis, the estimates of yield are believed to be still unreliable in many districts. Action is being taken with a view to establishing some method of obtaining reliable figures of yields by taking samples of the crop as it is being reaped.

In the important padi-growing areas of Kedah and Kelantan the unusual drought during the growing season resulted in very low yields. In Krian weather conditions were again adverse to the late planted crop, which, moveover, was severely attacked by stem-borers, with the result that the yield at the rate of 218 gantangs an acre was again much below the average, though better than that obtained in the 1928-29 season. A poor yield was also obtained in Larut and Bruas districts, but the crop in Upper Perak and in the irrigated areas of Kuala Kangsar District suffered less from weather conditions and the yield was fairly satisfactory.

In Perak South a good harvest of both "wet" and "dry" padi was obtained, except in that portion of Lower Perak District which lies along the banks of the Perak River.

Owing to drought and the attacks of stem-borers the harvest reaped in Province Wellesley was only about half of that usually obtained. In the Dindings and Penang Island the yield was good. In Selangor the crop was not so good as that of the previous season. Yields quite up to the average were obtained in the Negri Sembilan and Malacca where conditions during the growing season were normal.

In Pahang West the planted area was increased by 2,506 acres as compared with that of the previous year. The crop reaped in the padi areas along the banks of the river varied from place to place and was on the whole only moderate, but elsewhere it was good. In connection with the high yields obtained in Raub District of recent years, it may be recorded that departmental selected strains of padi have now become widely distributed throughout this District.

To summarise, crops were poor owing to adverse weather conditions in the important padi-growing areas in the north, but the season was normal and crops satisfactory in the southern half of the Peninsula.

1930-1931 Season.—In Krian the crop in its early stages suffered from the vagaries of the weather, as a result, planting was completed at very varying dates in different parts of the District. Another factor that will affect the yield is that in many of the deeper and richer lands which normally carry a long season padi, short season and lower yielding varieties have been planted. In part of the District there was much unplanted land as a result of the bad harvests in the two previous seasons, and the unpromising outlook for this year's season. While crop prospects in Krian were uncertain, those in Kuala Kangsar and Upper Perak Districts were more promising, the growing plants having suffered much less from the changes of weather.

In Province Wellesley planting was much delayed by drought, but during the last few months of the year a sufficient and regular rainfall provided optimum conditions for growth so that at the close of the year there was expectation of a good harvest. In Kedah also a good harvest was in prospect.

In Perak South a fair crop was expected, except in the padi lands along the Perak River where the crop was affected by drought. An increased area of dry padi was planted and gave promise of a satisfactory yield.

In Selangor, owing to the incidence of the fasting month in February, 1931, planting was commenced early, with the result that the growing crop suffered from drought in July and August and the harvest ripened in the rainy weather at the close of the year. It was considered, nevertheless, that a satisfactory crop would be obtained. In some parts of the Negri Sembilan and Malacca drought delayed planting, but on the whole the season was satisfactory and average crops were anticipated.

In Pahang West drought caused very irregular planting, but in spite of this, fair to average yields were being obtained in many places at the end of the year and were expected in those areas which had not been harvested. Exceptions were some of the padi lands along the Pahang River where yields obtained or expected were poor. An increase in the number of buffaloes was associated with a revival of the "tenggala" method of padi cultivation, a method peculiar to the banks of the Pahang River. In Pahang East both drought in the early part of the season and a flood at the end of the year were experienced. Poor yields were obtained from the areas harvested before the flood, while of those not harvested approximately 1,060 acres were destroyed.

Padi stem-borers, of which *Diatraea auricilia*, *Sesamia inferens* and *Schoenobius incertellus* are the most important, again proved destructive in some localities. They appeared on the young padi in Selangor soon after planting was completed and did considerable damage. At the end of the year there were indications that the Krian crop would again suffer from them to a not inconsiderable extent. Counts of the percentage of infected stems indicate that stem-borers are considerably more numerous in some parts of the country than in others. Investigations on these pests and experiments to determine the practicability of their biological control, especially by the egg parasite *Trichogramma nanum*, were continued throughout the year by the Assistant Entomologist stationed in Krian for this purpose.

Among other pests the rice caterpillar (*Spodoptera mauritia*) and the case worm (*Nymphula depunctalis*) were somewhat unusually prevalent on nurseries and on recently planted padi in several localities throughout the country. The leaf hopper (*Sogata furcifera*) again appeared on some 2,300 acres of padi in Krian but was controlled by changing the water on the fields. The padi-fly (*Leptocorisa acuta*) did damage to the young grain in Selangor and Johore.

Campaigns for the destruction of rats in padi fields were maintained in Krian, Province Wellesley and Malacca. In the two former areas unusually large numbers of rats were destroyed, but in spite of this some damage was caused by these pests to the standing crops in Krian where rather over one per cent. of the planted area was destroyed. In Province Wellesley and Malacca any serious damage was prevented. In other States rewards were not given for rats, but interest was aroused by means of propaganda and supplies of traps and poison were made available at cost price, while in Selangor large supplies of ready-mixed poison balls were distributed free of charge. These measures met with a satisfactory degree of success in many localities where padi growers made active use of them and thus protected themselves from any serious losses of crop in a season when rats appeared to be unusually numerous in all parts of the Peninsula.

The usual distributions of seed of pedigree strains of padi from the departmental experiment stations and test plots was made to selected cultivators for purposes of trial or demonstration. In that part of Krian which is the last to receive irrigation water, it was observed that in the unusually dry season of 1929-30, blocks of certain pedigree strains supplied by the Economic Botanist gave very fair yields, though the local strains gave practically no crop. In consequence, arrangements were made, with the co-operation of the District Officer, to provide large quantities of seed of these strains to those cultivators who wished to purchase it at cost price and about 5,500 gantangs were sold for planting in the 1930-31 season.

While in existing financial circumstances the food supply provided by the padi crop is of the greatest importance to its cultivators for their own consumption, the price obtainable in the coming year for all surplus padi produced locally is expected to be very low, owing to the effect of heavy crops in Burma and other producing countries on the price of imported rice.

A committee was appointed by His Excellency the Governor and High Commissioner, with the Director of Agriculture as Chairman, to enquire into Rice Cultivation in Malaya. This committee visited and issued separate reports on each of the padi-growing areas of the Peninsula. They also issued at the end of the year a progress report containing the results of their deliberations to the end of October. Their final report will, it is anticipated, be submitted early in 1931.

Oil Palm.

The estimated area of oil palm in Malaya is as follows :

Territory.	Mature.	Not determined.	Immature.	Total.
	Acres.	Acres.	Acres.	Acres.
Federated Malay States—				
Perak	2,541	1,881	7,958	12,380
Selangor	11,271	—	1,781	13,052
Negri Sembilan	600	—	302	902
Pahang	—	—	787	787
Total (Federated Malay States)	14,412	1,881	10,828	27,121
Straits Settlements	Nil	Nil	Nil	Nil
Unfederated Malay States—				
Johore	5,063	7,500	5,563	18,126
Grand Total ...	19,475	9,381	16,391	45,247

During the year six new palm oil factories were opened in Malaya. Of these five were of the centrifugal extraction type, and one, viz., Elais Plantations, Johore, was of the press type. It may be mentioned that the latter is the first factory of its kind to be erected in Malaya. An account of the undertaking was given in the *Malayan Agricultural Journal*, Vol. XVIII, No. 10, pages 497-51. In general, practice has favoured the centrifugal system of extraction in Malaya while in Sumatra the press system is preferred. Opinion is still divided as to which yields the most satisfactory results.

The production of palm oil in Malaya during 1930 was 3,253 tons valued at $903,768 and palm kernels 486 tons at $81,262.

Prices for palm oil declined sharply during the year from £33 a ton in January to £16 12*s*. in December, the average price being £23 10*s*. 3*d*. for the year.

A previously unrecorded disease of oil palm came to notice during the year which it would appear is probably occasioned by a species of Fomes related to if not identical with that occasioning root disease of rubber. Satisfactory methods of treatment have been worked out by the Department of Agriculture and are being applied on estates.

Experimental work in relation to oil palm has been continued at Serdang Plantation and certain estates. It includes investigations in relation to pollination, pruning, manuring, cultivation and drainage, and also investigations on the manufacturing side.

There has been considerable difference of opinion hitherto as to whether advantage attaches to artificial pollination of oil palms; experiments conducted by the Agricultural Department during the year appear to indicate that a decided advantage attaches to artificial as compared with natural pollination.

The experimental oil palm factory at Serdang Plantation was equipped during the year with a Krupp press. This will enable comparative work to be undertaken on the two methods of extracting palm oil that are at present practised.

Tea.

The estimated area planted under tea in Malaya is as follows:

	Acres.	
Federated Malay States—		
Perak	107	
Selangor	701	
Negri Sembilan	21	
Pahang	415	
	——	1,244 acres
Straits Settlements	Nil	
Unfederated Malay States—		
Kedah	700	
	——	700 ,,
		1,944 ,,

Of this 1,529 acres are estimated to be planted on lowlands and 415 acres on uplands.

In Selangor there is an appreciable area planted in tea by Chinese market gardeners, the tea being manufactured by rather crude methods. The attempt was made during the year to interest the people in improved varieties and methods of preparation.

In Kedah one large plantation of about 700 acres exists which during the year completed the erection of an up-to-date factory. Tea produced by this estate is now being sold on the local market.

Increasing interest attaches to the possibilities of cultivating upland tea in the mountainous regions in the centre of the Peninsula. Developments in this direction are being facilitated by the opening of the newly constructed road to the Cameron Highlands area in Pahang. Approximately 415 acres have already been planted in the crop and about 5,857 acres of land have been alienated mainly for this form of cultivation in these regions, while alienation of a further area of 6,080 acres has been approved. Experiments conducted by the Agricultural Department give some grounds for the belief that these regions are well adapted for the growth of the finer type of tea, and this has been strengthened as the result of a visit paid by a member of the agricultural staff to the tea-growing districts of Ceylon, Southern India and Assam.

The experimental investigations both on highland and lowland tea were advanced a stage further and pluckings were made from the tea areas at the Experimental Station at Cameron's Highlands. Small quantities of hand-made tea are being produced.

Arrangements were made for expanding the experimental area under tea at Cameron Highlands, while further additions were made to the lowland tea at Serdang. The erection of an Experimental Tea Factory at Serdang was commenced and proposals approved for the installation of tea-making machinery at Cameron Highlands.

Pineapples.

Apart from small areas cultivated by small-holders for local consumption, the growing of pineapples for export is confined to the States of Johore and Selangor and to the Settlement of Singapore. With the exception of about 3,000 acres the crop is exclusively cultivated as a catch-crop between young rubber.

The estimated acreage under the crop in the administration areas named below is as follows :

	Acres.
Singapore	8,000
Johore	40,000
Selangor	4,000
Total ...	52,000

The crop is manufactured in 18 canning factories, of which 5 are situated in Singapore, 12 in Johore, and one in Selangor; during the latter part of the year five were closed down.

The produce is exported in the form of tinned pineapples and goes principally to Great Britain and certain of the Dominions. In 1930 Malayan pineapples constituted 85 per cent. of the total consumption of tinned pineapples in Great Britain. The quantities and values of exports of Malayan tinned pineapples during the past two years have been as follows:

	Quantity.	Value.
1929	1,700,000 cases ...	$9,233,886
1930	1,618,919 ,, ...	7,859,026

Prices for fresh and tinned pineapples fell to a very low level during the year. In the main cropping season 100 ordinary fruits were sold for cents 80 to $1.20 and 100 selected fruits $1.50-$2.50. The closing prices of 1½ lb. pineapple cubes were $3.30 to $3.40 per case of 48 tins. These prices were hardly sufficient to pay for the cost of cultivation and transport of the fruit or to leave any margin of profit for factories.

It may be mentioned that the low market is not apparently due to over-production, as at the end of the year stocks were lower than at any time during the five preceding years. The present market condition is apparently to be attributed to the general trade depression, combined with unsatisfactory economic conditions of the industry itself.

The Malayan Information Agency staged exhibits of Malayan tinned pineapples at the Antwerp Exhibition and at various Exhibitions and Shows in Great Britain. These displays have helped materially to increase the demand for Malayan pineapples.

A very thorough investigation into the economic side of the industry was made during the latter part of the year. It would appear that if more satisfactory internal economic conditions can be brought about the industry possesses considerable potentiality for expansion. During the year provision was made by the Governments of the Federated Malay States, the Straits Settlements and Johore for the inauguration of a pineapple experiment station at Lim Chu Kang in Singapore Island where a site comprising 33 acres was selected and the development of an experiment station commenced. In addition experiments with pineapples were laid out at the Experiment Station at Serdang.

Coffee.

It is estimated that approximately 9,928 acres of coffee were under cultivation in Malaya during 1930, the area being divided as follows :

	Acres.
Federated Malay States	5,211
Straits Settlements	867
Unfederated Malay States	3,850

A considerable proportion of the area is interplanted between young rubber.

Imports of raw coffee into Malaya amounted to 3,793 tons valued at $1,702,490.

Practically the entire area is planted in the lowland and comprises mostly the Robusta type.

Experiments at Cameron's Highlands have shown that Coffee Arabica can be satisfactorily grown there, and there seem to be prospects of some plantation development in this variety at that point.

Damage has again been recorded from certain estates owing to the attack of the coffee berry beetle borer, *Cryphalus hampei*.

Experimental work on coffee has been continued at Serdang and comprised mainly trials with a number of varieties.

Tapioca.

Tapioca continued to be cultivated on some scale mainly as a catch-crop between young rubber in Kedah and Johore in which two States the manufacture of tapioca is carried on in 28 factories. Elsewhere the crop is grown on a small scale mainly for direct consumption.

The estimated area under the crop is as follows:

	Acres.
Federated Malay States	5,035
Straits Settlements	847
Unfederated Malay States	30,840

Net exports of tapioca were as follows:

Flake	10,529 tons	valued at $	976,616
Flour	512 ,,	,,	23,227
Pearl	20,221 ,,	,,	1,991,635

Net imports of tapioca refuse were 987 tons, valued at $13,497.

Prices for tapioca ranged between $3.90 and $6.00 per picul for flake, the average being $4.73; and $5.40 and $8.00 per picul for pearl, the average being $6.40. Experimental work on the crop continued during the year.

Tuba Root.

Interest in this crop continued to expand and the product is meeting with an increasing demand for use in the preparation of insecticidal mixtures.

The present area under the crop is estimated to be as follows:

	Acres.
Federated Malay States	424
Unfederated Malay States	4,000

Gambier.

This crop continued to be grown mainly as a catch-crop between young rubber in Johore. The area planted was estimated to be 2,943 acres. Net exports were 2,695 tons valued at $625,995.

Cloves and Nutmegs.

These crops continued to be grown on a small scale in Penang and Province Wellesley. Net imports of these crops were:

	Tons.
Cloves	63
Nutmegs	666

Formerly they were much more extensively grown but both crops are subject to certain insect pests which have had the effect of reducing the area cultivated to very small proportions.

An article on the insect pests of the clove tree and on the clove industry in the island of Penang appeared in the *Malayan Agricultural Journal* during the year.

Areca Nuts.

This crop is extensively grown on native holdings throughout the Peninsula especially in Johore. The estimated area under the crop in the various States is as follows:

	Acres.
Federated Malay States	933
Straits Settlements	57
Unfederated Malay States	11,343

The net exports for the year amounted to 23,256 tons valued at $5,148,911.

Fruit.

The total areas under fruit trees in Malaya are approximately estimated at 4,395 acres.

During the fruiting season supplies have been fairly plentiful for the various town markets, but owing to the relatively small areas grown a considerable part of the supplies are imported from the Netherlands East Indies, China, Australia and the United States. The extension of fruit cultivation to supply internal demand would appear to be worthy of serious attention. Imports of fruits into Malaya during 1930 were valued at $3,765,091.

Vegetables.

Town markets also create a large demand for fresh vegetables, which is met in part by Chinese market gardeners at various centres in the Peninsula. Supplies from these sources are, however, supplemented by large imports from Sumatra and China so that measures for increasing the local supply are worthy of attention.

Imports of vegetables into Malaya in 1930 were valued at $6,104,371.

Tobacco.

Increasing interest was manifested by small planters in this crop in certain parts of Malaya, particularly in Province Wellesley and in South Kedah where about 500 acres were planted.

There seems to be no adequate reason why tobacco cultivation should not be undertaken in Malaya with fair prospects of success, with a view particularly to the reduction of imports. No attention has as yet been devoted to the possibilities of producing bright leaf in Malaya for the manufacture of cigarettes, which are imported into the country in enormous quantities, and also of wrapper tobacco. In circumstances such as at present prevail when additions to the revenues of the country are of prime importance the possibilities contained in this direction should certainly not be overlooked and provision for experimental work on the crop has been entered in the estimates for 1931. The figures for quantities and values of imports of tobacco into Malaya for 1930 are as follows:

	Lbs.		$
Cigars	121,098	...	261,527
Cigarettes	6,102,960	...	17,016,122
Manufactured tobacco	6,183,122	...	3,906,836
Unmanufactured tobacco	7,680,906	...	2,661,731
Total ...	20,088,186	...	23,846,216

LIVESTOCK.

The position in relation to livestock in the Malay Peninsula cannot be regarded as entirely satisfactory; as pointed out in the last annual report the needs of the situation are for a definite policy for measures to increase the domestic production of livestock and the products of animal husbandry in the Peninsula. To illustrate the dependence of Malaya on imports of livestock and animal products the following data may be quoted for the past year:

Articles.	How stated.	Imports.		Exports.		Nett Imports.	
		Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
			$		$		$
Cattle (live)	Nos.	31,565	2,850,302	564	47,540	31,001	2,802,762
Goats „	„	21,596	388,271	7	140	21,589	388,131
Sheep „	„	43,527	595,877	5	168	43,522	595,709
Swine „	„	181,008	4,537,169	384	10,776	180,624	4,526,393
Poultry „	„	1,135,402	1,013,592	14,633	1,733	1,120,769	1,011,859
Game „	„	32	175	7	6	25	169
Poultry and Game (dead) ...	Tons	156	191,971	1	4,096	155	187,875
Beef, frozen, salted, etc. ...	„	1,427	814,900	35	24,246	1,392	790,654
Mutton and lamb	„	501	322,170	22	22,216	479	299,954
Pork, fresh, frozen, salted, bacon and hams	„	828	963,698	38	46,323	790	917,375
Meats, tinned or canned and other sorts	„	586	626,905	137	98,912	449	527,993
Butter, tinned	Cwts.	11,106	713,722	1,178	79,603	9,928	634,119
„ frozen	„	7,350	514,989	548	49,565	6,802	465,424
Ghee	Tons	1,274	1,443,328	254	266,558	1,020	1,176,770
Vegetable cooking fat	„	439	199,473	36	19,325	403	180,148
Eggs, fresh and salted	In Centals	520,975	1,342,695	32,412	92,805	488,563	1,249,890
Lard	Tons	1,071	408,477	364	146,583	707	261,894
Milk, condensed and sweetened	Cases	1,169,714	11,495,534	127,515	1,290,673	1,042,199	10,204,861
„ unsweetened	„	48,808	467,327	7,405	64,252	41,403	403,075
„ sterilised, natural ...	„	97,336	784,326	20,890	145,580	76,446	638,746
„ powdered or preserved and other sorts	Lbs.	634,671	436,426	49,015	38,249	585,656	398,177
Total ...	...	...	30,111,327	...	2,449,349	...	27,661,978

While it is obvious that the dependence of Malaya on imported livestock and products of animal husbandry must continue to a considerable extent, at any rate for many years to come, there seems to be reason to believe that it is capable of being reduced appreciably. The obvious lines which such developments can take are—

(*a*) the improvement of dairy cattle and the increased production of milk locally;

(*b*) the extension and improvement of cattle breeding for meat supply and for draft purposes;

(*c*) the improvement and increase of small livestock, particularly goats, pigs, etc.;

(*d*) the improvement and increase of poultry.

In relation to (*a*) provision is at present very inadequate and the country is almost entirely dependent on imported supplies of milk and butter. There are a few small dairies outside the large towns such as Singapore, Kuala Lumpur and Penang and also a number of Indian cow-keepers, while at Ipoh an interesting system is being worked under the supervision of the Sanitary Board whereby cows belonging to Indian cow-keepers are brought to a central milking station. Very little systematic work has as yet been done to improve the breed of cows for milking purposes and for the most part they are of poor yielding strains.

An obvious line of development consists in the introduction of the Friesland breed of cattle which has been shown by experience in many tropical countries to be well adapted, both in pure strains and in crosses with local strains, for the improvement of milk supply.

In this connection progress may be reported in that at the small experimental dairy at Serdang, five Friesland cows and two Friesland bulls have recently been imported. At Singapore the Cold Storage Co. have during the year inaugurated a very interesting experiment in the shape of building a model dairy and the stocking of it with animals of the Friesland breed. The dairy is very well designed and represents an important contribution to the solution of this problem. Concurrently work was commenced during the year on the improvement of the dairy herd at Fraser's Hill which at present comprises a small number of Jersey cows. The improvements undertaken included the erection of new buildings and the introduction of high grade Friesland cattle from South Africa; these efforts at least entail the introduction of a valuable breed into Malaya. The work done, however, requires to be extended considerably and followed up along defined lines if the situation is to be appreciably improved.

In relation to the supply of cattle and buffaloes for meat and draft purposes the principal areas in which the raising of cattle and buffaloes is undertaken are in Kedah, Kelantan, Trengganu, Upper Perak and Pahang. In Kedah and Kelantan, particularly the latter, large numbers of cattle are pastured on "sawahs" between two crops of rice; during the period the rice is growing there is no provision of pasture reserve, the animals being left to pick up a living as best they can along "batas", roadsides, etc. In consequence heavy toll is taken of the fertility in the soils with the result that frequently poor rice crops are combined with the production of unthrifty cattle for which it is often difficult to find a market. In Kelantan cattle are markedly undersized; in Kedah they are somewhat better, but still far from being satisfactory.

The need appears to be for the provision of additional grazing grounds and the grading up of cattle. This is not altogether easy owing to the high cost of converting jungle into pasture and the doubtful economic soundness of so doing.

In Pahang there appears to be a definite need for an increase in the number of buffaloes which have been greatly reduced owing to the effects of the floods of 1926 and the subsequent rinderpest. A proposal has been put forward by the Government Veterinary Surgeon of Pahang West for the establishment of a stud farm for buffaloes in that State. In 1922 a proposal was also put forward for the establishment of a stock farm at Kroh; neither of these projects has so far materialised, however. In addition to the provision of grazing grounds, there appears to be need for better sires and the elimination of weedy animals for breeding purposes. The problem is not an easy one, but there seems to be a considerable scope for the extension of stock raising on more or less well-defined lines; in this connection the possibilities of using exhausted mining areas and areas immobilised by anti-malarial works, for the production of fodder for grazing seem worthy of attention.

Some attention was devoted during the year to the possibilities of stock raising in Cameron Highlands. It appears that prospects for grazing in this region are distinctly limited owing to the sharply accented nature of most of the country. On the other hand there appear to be distinct possibilities of cattle raising on some scale on the soiling system.

In relation to small stock, there is scope for considerable extension particularly in relation to pigs. In order to improve the strains a number of Middle White and Large Black pigs were imported at the Serdang Station, while the work of the Singapore Cold Storage Co. on their pig farm in Singapore Island is also noteworthy; during the year this farm was considerably extended and improved and the number of animals increased.

Very little has so far been attempted in relation to the improvement of sheep and goats. There are not inconsiderable numbers of these animals in the Peninsula and plans for improving the stock in this respect would be productive of benefit; a small herd of sheep for breeding and sale of selected animals to Malay breeders continued to be maintained by the Agricultural Department at Pekan.

Proposals for the improvement of poultry have already been made and steps have been taken for the importation of birds and the establishment of a small poultry farm at Kuala Kangsar under the charge of the Agricultural Field Officer, while in Negri Sembilan the Acting Agricultural Field Officer has continued on his own initiative to maintain a small poultry station. There are also a few poultry fanciers throughout the country who have continued to accomplish some useful results. On the other hand throughout the country poultry continues to be raised on haphazard lines. There is a very large and it is believed unnecessary importation of poultry and eggs from the Dutch East Indies. Proposals have been discussed for the establishment of a central poultry breeding station at Serdang, but so far it has not been possible to take steps for its establishment. The most promising method of improving poultry is believed to lie in the distribution of birds of improved strains among small fowl keepers for crossing with local breeds. This could probably be best effected by the establishment of sub-stations under the charge of Field Officers in the different States which would be supplied with pure strains from the central station at Serdang.

The raising of ducks is very largely practised by Chinese. With the idea of improving the position to some extent a small number of Aylsbury ducks were also imported for the Kuala Kangsar station.

The important point in relation to improvement of poultry in the tropics is that experience has shown that the most useful line does not lie in the widespread popularisation of pure strains from Europe but in raising half-bred strains between the local fowl and the imported birds which will combine the resistance to disease of the local bird with the improved size and laying capacity of the imported strains.

CONCLUSION OF PART I.

In this section of the report an attempt has been made to review the agricultural conditions of the Peninsula during the past year at somewhat greater length and in somewhat greater detail than has before been practised.

It is believed that such an attempt may serve a useful purpose at the present juncture inasmuch as faced as Malaya is with the most serious economic crisis in its history some reorientation of agricultural policy is inevitable, and in such circumstances a general critical review of the situation may prove of value.

A survey of the position demonstrates two points, viz.: (i) that practically all export staples are, as the result of economic conditions and over-production, at price levels which cannot yield satisfactory profits, and (ii) that Malaya is dependent on imports for a very large number of necessities of life for the production of which local conditions are suitable. Whatever may be the financial result when the parity of prices for export staples rules at values surpassing the exchange value of imported commodities it seems clear that in existing circumstances the most immediate and direct palliative for economic difficulties lies in the extension of local production to replace imports so far as may be practicable.

Part II.

THE WORK OF THE DEPARTMENT OF AGRICULTURE.

Staff.—The establishment of the Department of Agriculture on the 30th December, including the Director of Agriculture, comprised 48 European officers; of these, 27 were on the research side, 12 were on the field side, two on the instruction side, three were seconded for duty in the Unfederated Malay States, two for duty with the Rubber Research Institute of Malaya and one for duty with the Co-operative Department. Details in relation to staff are given in the appendix.

INTRODUCTORY.

At the commencement of the year proposals for the reorganisation of the department were submitted to Government by the Director comprising schemes for the regrading and redistribution of duties of both the European and Asiatic staff, the recruitment and training of Asiatic staff, the enlargement and extension of the field work including a comprehensive provision of test and experiment stations throughout the country and the considerable enlargement of extension work, the devising of an agricultural policy for the department, the provision of new buildings and laboratories and the co-ordination of the work in the Straits Settlements and Federated Malay States with that in the Unfederated Malay States. By the end of the year agreement had been reached on practically all of the proposals and action had been taken to give effect to certain of them including particularly the proposals for a provision of additional experiment test and demonstration stations and the provision of new buildings for the department which are badly needed.

The buildings of the new School of Agriculture at Serdang were completed during the year and a considerable proportion of the equipment therefor was procured. The curriculum for the school was finally approved, steps were taken for the recruitment of the necessary staff, and an Advisory Committee appointed. The school will, it is anticipated, commence work in May, 1931.

A start was made on the programme of proposals for establishment of agricultural stations and test plots throughout the country. The scheme for operating padi test plots was recast and standardised lines for experiment both with new selected strains of padi seed and with manures were worked out, experiments on the cultivation of padi were also begun. New padi test plots were approved at Glugor in Penang, Bukit Merah in Province Wellesley, Lenggong in Perak, Alor Gajah in Malacca, while working conditions were considerably improved at Pulau Gadong in Malacca and at Talang in Perak. A start was made with the opening of a general agricultural station at Sungei Udang in Malacca and with the improvement of the Kuala Kangsar agricultural station, while sites were selected for agricultural stations at Lenggong, Slim, Tapah, Temerloh, Kuantan, Rembau and Jasin.

In July a European Agricultural Officer was seconded to take charge of agricultural services in Kedah, subsequently a rice-breeding station was laid out by him at Teluk Chenghai near Alor Star. In April the Director of Agriculture visited Kelantan and put forward proposals for organising agricultural services in that State as a result of which a European Officer was seconded for that purpose in December. During the year a request was put forward by the Johore Government for the secondment of a second agricultural officer to that State; it is anticipated that this request will be acceded to during 1931.

Some discussion also took place during the year concerning the possibility of establishing agricultural services in Trengganu, Brunei and Labuan; it is hoped that in due course these will materialise; when this is accomplished the whole of the Malayan administrations will have been provided with agricultural services. Close attention has been directed to the question of the recruiting and training of Asiatic staff for it is felt that on these the successful working of the department largely depends, the schemes for providing for these were entirely recast during the year in connection with reorganisation proposals. Under the new scheme the Asiatic staff becomes divided into two classes—the higher or Agricultural Assistants being English speaking, the lower or Agricultural subordinates being vernacular speaking.

The proposals are connected with the enlargement and better organisation of the extension and inspection services, and for this purpose it is proposed that the Asiatic staff should be sub-divided into instructional and inspectional sides. Considerable progress has been made in this direction and as a result efficiency has been increased.

Close liaison has been maintained with the Rubber Research Institute and the Co-operative Societies Department. The plan formulated during the preceding year and alluded to in my last report, whereby the Agricultural Department remains the recognised means for controlling disease and disseminating information amongst small-holders has worked well. During the year the scheme for the establishment of a propaganda motor caravan operated jointly by the three organisations came into operation, and by the end of November the caravan was able to take the road. The equipment comprises a cinema projector together with a collection of exhibits, drawings and lantern slides; it is attended by two Asiatic lecturers, one representing the Agricultural and the other the Co-operative Department.

Exhibits were staged jointly by the Department of Agriculture and the Rubber Research Institute at six agricultural shows during the year, the exhibits in all cases being designed with the object of reaching particularly the small-holders.

Efforts were continued to extend the distribution of planting material for minor crops and fruit trees, and it was arranged that as each agricultural station came into being, plant distribution work should comprise an integral part of the work.

A beginning was made with the systematic distribution of selected padi seed in Krian on a basis of sale, it is hoped in due course to extend this throughout Malaya.

The activities of the department in relation to school gardens have been maintained and extended on the lines indicated last year and a gratifying improvement in work in this direction is visible. Close liaison has been maintained with the Education Department in this connection. It is held that school gardens constitute one of the best methods of approaching the adult population in relation to new ideas and of imparting an agricultural outlook to the younger generation. In this connection it is interesting to record that in Malacca a start has been made with organising the home garden system which has proved of value in Ceylon.

In another direction comment is called for on the progress which has been achieved in the collection of agricultural statistics; as indicated last year, the Deputy Registrar-General of Statistics has been attached to the staff of the Department of Agriculture for the purpose. The organisation of statistical service in relation to rubber was completed during the year and a start made with the betterment of the collection of statistics of other crops in which considerable need for improvement exists. The arrangement whereby the above-named officer was seconded to the Department of Agriculture was extended for another year as from 1st June, 1931.

Mention should be made of the completion of the experimental palm oil factory at the Serdang Experimental Station and the commencement of the erection of an experimental tea factory at the same place, of the establishment of an experiment station for investigating questions in relation to pineapples in Singapore which was commenced and the establishment of a model dairy, poultry and vegetable farm at Fraser's Hill, the buildings for the latter were completed by the end of the year.

The extensive experimental investigation carried out by the Entomological Division on the possibility of the control of padi stem-borer by egg parasites requires notice. If this work is successful it may have far reaching consequences.

Mention should further be made of the extension of activities in relation to work on coconuts; manurial experiments with this crop have now been laid out on nine estates and plans formulated for the extension of the breeding station at Klang to include various trials with cultivation and manuring.

Satisfactory progress has also been made with the scheme for research on copra, part of the cost of which is defrayed by a grant from the Empire Marketing Board.

A very successful Agricultural Conference was held during November; this was attended by members of the staff of the Agricultural Department, the Rubber Research Institute, the Co-operative Department and the Veterinary Department and a very wide range of topics was discussed. The Conference was opened by the Honourable the Chief Secretary; it is yielding considerable results in the way of better definition of aim and clarification of policy.

The Malayan Agricultural Journal appeared in its new enlarged and more popular form in January, 1930, and was published throughout the year on the 15th of each month. The Journal has met with wide spread appreciation and there is no question that as a means of disseminating information it is serving an increasingly useful purpose. Concurrently the Bulletins of the Department were recast and issued in two series, a general and scientific series. In all eight special bulletins appeared during the year containing the results of scientific work. Vernacular publications in Malay and Chinese continued to be issued and were widely read and appreciated.

The Advisory Committee of the Department met three times during the year; its constitution was as follows:

The Director of Agriculture, Straits Settlements and Federated Malay States (*Chairman*);
The Director of Co-operation, Straits Settlements and Federated Malay States;
The Director, Rubber Research Institute;
The Principal, Sultan Idris Training College;
The Hon'ble the Raja Muda of Perak;
The Hon'ble Mr. H. B. Egmont-Hake;
Choo Kia Peng, Esq.;
J. Melville, Esq.;
W. A. Stanton, Esq.;
A. P. Mackilligin, Esq.;
G. S. Reis, Esq.;
R. E. M. Michaux, Esq.;
Assistant to Director of Agriculture (*Secretary*).

Departmental and Inter-departmental Committees dealing with Copra Research, Publicity, Propaganda and Disease Control were maintained and met as required.

The Director of Agriculture was again elected Chairman of the Board of the Rubber Research Institute and continued to maintain close touch with the work of that Institution.

He continued to serve as Chairman of the Planters' Loans Board. He officiated as Chairman of the Committees appointed by the High Commissioner to report respectively on measures for extending rice cultivation and for improving the condition of the pineapple industry, and served as a member of a number of other committees.

During the year, every State and Settlement in the Peninsula was visited by him, and inspection visits paid to a large number of estates, plantations, experiment stations, etc.; in all some 8,000 miles were travelled on duty by road, rail and seas during the year.

The year has witnessed a very considerable extension of the activities of the department and it is believed that the work done is meeting with a measure of appreciation from the public which the department is intended to serve.

It is with pleasure that I again record the loyal and energetic manner in which the whole staff of the department have responded to the considerable additional calls which have been made upon them.

In the following paragraphs the principal lines of activity of the various divisions of the department are briefly summarised.

The complete reports of the various officers will be published as separate bulletins of the department at a later date.

FIELD DIVISION.

The activities of the Field Divisions extended considerably during the year, and a start was made with the sub-division of its activities into two distinct branches, viz., the instructional and the inspectional branches respectively.

INSPECTIONAL WORK.

The inspection work was continued on customary lines, an effort was made to accomplish as much as possible by persuasion and precept, recourse being only had to prosecution when other means failed.

Mouldy Rot continued to be the most important disease of rubber calling for treatment. In one or two places fresh outbreaks were recorded towards the end of the year, particularly in South Perak, Selangor and Negri Sembilan. These were effectively dealt with.

Oidium leaf disease gained prominence especially in Negri Sembilan and Malacca. It was made a notifiable disease under the Agricultural Pests Ordinance and Enactment. The situation is being handled by the department acting in collaboration with the Rubber Research Institute and is not considered to give cause for alarm.

During the year 14,542 notices were served on cultivators for the presence of disease on plantations, 867 prosecutions were entered against cultivators for non-compliance with notices served and 759 convictions obtained. The data for the different administration areas concerned being as follows:

Federated Malay States	5,918 ...	414 ...	375
Straits Settlements	3,313 ...	157 ...	149
Johore, Unfederated Malay States ...	5,211 ...	296 ...	235
	14,542 ...	867 ...	759

Figures for Johore are included by courtesy of the Johore administration. Figures for Kedah are not available. At the Agricultural Conference the question of greater uniformity in plant disease protection legislation throughout the Malay Peninsula was discussed and certain suggestions made for improving and unifying practice in relation to plant importation. Proposals were also discussed and recommendations made for the erection of fumigation plant at Penang and Singapore, for the treatment of imported plant materials.

Considerable attention was devoted to the condition of small native rubber holdings and reports thereon were regularly submitted to the Director of Agriculture and through him to the Rubber Research Institute.

INSTRUCTIONAL WORK.

Agricultural stations were maintained at Kuala Kangsar, Kuala Lipis, Seremban and Pekan and a fruit nursery at Bukit Pringit in Malacca. These stations are designed for the trial and demonstration of minor crops, new agricultural methods and for the distribution of planting materials. The work at Kuala Kangsar and Kuala Lipis was considerably improved and extended during the year.

Plans were approved for the creation of new agricultural stations at Sungei Udang and Jasin in Malacca, at Tapah, Lenggong, Sitiawan, Utan Melintang and Slim in Perak, at Rembau and Kuala Pilah in Negri Sembilan, at Kuantan and Temerloh in Pahang, at Bukit Mertajam in Province Wellesley and at Sigari in the Dindings. In the majority of cases sites were selected after taking soil samples, and work was commenced on the clearing and laying out of the station at Sungei Udang. The stations form part of the programme for increasing the extension work of the division, they vary in size from 10 up to 30 acres and will when completed vastly increase the effectiveness of the work of the division.

Padi experiment stations were maintained at Pulau Gadong in Malacca and at Talang near Kuala Kangsar in Perak. The appointment of an additional Field Officer for Central Perak has enabled work at this latter station to be improved. Work at Pulau Gadong comprises pure line breeding, tests of new strains and manurial trials. This year the station was extended by the acquisition of additional land, by the erection of a new store and of quarters for the Asiatic Officer in charge. In addition the work undertaken there included trials with tractors and implements in relation to rice cultivation. At Talang numerous replicated trials of selected strains were carried out, as well as a comprehensive series of manurial experiments. Padi test plots were maintained at Dong, Temerloh and Pekan in Pahang, at Jelebu in Negri Sembilan. New padi test plots were established at Kuang in Selangor, at Glugor in Penang, at Bukit Merah in Province Wellesley, at Lenggong in Perak, at Alor Gajah in Malacca, on all these replication trials with a number of selected varieties were carried out on randomised plots. At Selinsing in Krian certain manurial and cultural trials were conducted, and on the reslimed areas at Kamunting the first crop of padi was planted and made satisfactory growth. It may be added that a rice experiment station was inaugurated by the Kedah Government at Teluk Chengai in Alor Star and that the Perlis Government established three padi test plots in that State. In Singapore a start was made with the establishment of a Pineapple Experiment Station, with it will be combined a section for the distribution of planting material of fruit trees and other crops.

School Gardens.—The division continued to exercise supervision over the working of school gardens in the Federated Malay States and Straits Settlements. Considerable attention was directed to the standardisation of work of school gardens and a set of standard instructions for use in this connection was drawn up by a Committee of the Agricultural Conference.

Rat Destruction.—The organisation of rat control in the padi areas of Krian, Province Wellesley and Malacca was maintained on the same lines as in previous years. In Krian and the Province the reward for tails was reduced during the last two months of the year from one to a half cent each.

The following table gives figures of tails collected and expenditure incurred during 1929 and 1930:

	Year.	Tails collected.	Total expenditure.	Average cost per tail.
			$ c.	*cents.*
Krian	1929 ...	623,712 ...	15,114 42 ...	2.42
	1930 ...	1,791,790 ...	26,441 09 ...	1.47
Province Wellesley ...	1929 ...	579,972 ...	12,993 02 ...	2.24
	1930 ...	1,514,928 ...	22,601 84 ...	1.49

In Province Wellesley rat damage to the padi crop throughout the year was negligible. In Krian on the other hand, notwithstanding the large number of rats killed, the damage caused to the padi crop was of some importance for the first time in the five years since the campaign was started. The reasons for the damage were being carefully investigated at the end of the year in order to ascertain if any modification of the organisation appeared necessary.

In Malacca during the early part of the year the campaign received but little support from padi growers, but later interest was aroused by means of propaganda with the result that 75,817 tails were collected of which the great majority were obtained during the last quarter of the year when the padi crop was on the land.

In the other parts of the country traps and poisons were made available at cost price, while in Selangor poisoned baits were distributed free. Interest was aroused by means of leaflets in Malay and other methods of propaganda including exhibits at local shows.

These measures proved reasonably successful, especially in the Negri Sembilan and parts of Selangor where rat damage to padi was considerably reduced in a season when rats were unusually numerous.

Agricultural Shows.—Shows were held as follows during the year:

Seventh Malayan Exhibition, Kuala Lumpur, April 19th to 21st.
Kedah Agricultural Show, Alor Star, July 10th and 11th.
Negri Sembilan Agricultural Show, Seremban, July 25th and 26th.
Malacca Agricultural Show, Malacca, July 26th.
Perak North Agricultural Show, Taiping, August 23rd and 24th.
Pahang East Agricultural Show, Kuantan, August 28th.
Pahang West Agricultural Show, Temerloh, September 27th.

In the organising of these, Agricultural Field Officers took a leading part working in most cases in conjunction with the Malayan Agri-Horticultural Association.

Plant Distribution.—Considerable quantities of plants and seeds were distributed through the agency of the Division during the year consisting of selected padi seed, planting materials of various vegetables, cereals and fruit trees to small cultivators and market gardners, as well as a considerable amount of material to school gardens.

Chinese Agriculture.—Chinese Sub-Inspectors of Agriculture were maintained in Perak and Selangor, while a proposal was approved for stationing an additional Chinese Sub-Inspector in Singapore. The work of these officers consists in itinerant instruction amongst Chinese agriculturists, distribution of planting material, organisation of demonstrations and assisting Land Officers as and when required in demarcating areas, settling disputes, etc., amongst tenants. There is reason to believe that the work of these officers is having some effect in improving the condition of an important class of agriculturists whom it is notoriously difficult to reach.

AGRICULTURAL DIVISION.

EXPERIMENTAL PLANTATION, KUALA LUMPUR.

Crops in the Field.—The area under rubber has been maintained in good order. The average number of trees tapped was approximately 3,710 and the dry rubber harvested during the year amounted to 20,633 lbs., which is equivalent to a yield of 5.6 lbs. per tree. The quantity of dry rubber sold during the period under review amounted to 21,867 lbs., which realised $3,657.65 or an average price of 16.73 cents per lb. for all grades. Cropping experiments were carried out on a small scale with the following economic plants—maize, sorghum, soya bean and groundnuts. Varietal trials were also conducted with a collection of tapioca varieties previously introduced from Mauritius. Records were kept of the individual yields of a number of Brazil nut trees growing on this plantation and the highest yield during the year was obtained from tree No. 19, which produced 195 fruits and 59 lbs. of cleaned nuts. A full description of the behaviour of the Brazil nut tree in Malaya was published as a Special Bulletin, General Series No. 2, in March of this year.

EXPERIMENTAL PLANTATION, SERDANG.

Development.—The development work undertaken during the period under review mainly consisted of planting up additional experimental areas with oil palm, tea and pineapples, the erection of new buildings and the installation of machinery for the experimental manufacture of palm oil and tea.

The equipment of the experimental oil palm factory at Serdang was augmented during the period under review by the installation of a Stork Single Press, complete with stirring kettle and hydraulic pump, for the extraction of palm oil. This press has a capacity of 500 kilogrammes of cleaned fruit per hour, which is approximately the same capacity as the centrifugal extractor installed during 1929. It will now be possible to test the comparative efficiency of the press and centrifugal systems of extracting palm oil from fruit produced under exactly the same conditions. At the same time it will prove of considerable value in demonstrating to visitors an alternative system of extracting palm oil which is universally adopted in the Dutch East Indies. A further valuable addition to this plant is the installation of a Laval Separator for the purification of palm oil, the erection of which is now nearing completion. By the utilisation of this purifier it will be possible in future to produce palm oil practically free from dirt and moisture.

Distribution of Planting Material.—A large quantity of planting material was distributed during the year. This included 120,300 oil palm seeds, 35,000 Guinea grass cuttings, 20,000 cover crop and green manure cuttings in addition to seeds and cuttings of various food crops, fruit seedlings, coffee seed and seedlings and cuttings of numerous shade trees.

Plant Introductions.—The most important introductions made during the year comprised seed of various jats of both Assam and Ceylon tea, seed of several cover crop and green manure plants from Ceylon and Southern India principally for use in tea areas, seed and cuttings of several food crops and seed of the round-podded jute (*Corchorus capsularis*) from Bengal.

Labour.—The resident labour force consisted of 438 Tamils, including men, women and children. The health of the labour force continued to be good.

Buildings.—The new buildings erected during the year included a garage for visitors' cars, a fumigatorium, quarters for cattle attendants and a dipping tank for the stock farm. Considerable progress was made in the construction of an experimental tea factory and at the close of the year the structural steel work, side and interior walls, with cement-asbestos roof were erected. All existing buildings were maintained in good order.

Lighting and Water Supply.—Electric light and power became available on the plantation during September, while the Public Works Department made good progress in the installation of a water supply for the plantation and Agricultural School.

EXPERIMENTAL PLANTATION, CAMERON HIGHLANDS.

Development.—A further 100 acres of jungle was felled during the year with a view to increasing the area under tea, Arabian coffee, cardamoms, fruit and other crops, which have so far shown satisfactory growth on the Highlands.

Plant Introductions.—The following is a list of the principal planting material introduced during the year—seed of *Aleurites montana* from the Royal Botanic Gardens, Kew, seed of *Albizzia moluccana*, *A. stipulata*, *Erythrina lithosperma* (Thornless dadap), *Grevillea robusta*, *Acacia decurrens*, *Gliricidia maculata*, *Indigofora endecaphylla* and *Pithecolobium dulce* (Madras thorn) from Ceylon; *Chicooca Bermudiana* from Bermuda; seed of a conifer *Pinus insularis* from the Philippines and seed of *Eucalyptus terticomis* and *E. robusta* from Mauritius.

Nurseries.—The nursery beds are well stocked with seedlings of various shade trees and green manure plants suitable for interplanting with tea. Attention has also been given to the raising of ornamental trees for planting up various open spaces on the Highlands.

Crops in the Field.—The area of about 27 acres planted with nine distinct varieties of Assam tea has so far shown excellent growth. The oldest tea which was planted in January, 1926, gave a calculated yield of 709 lbs. of made tea per acre in the third year of cropping. The plots are all on fine plucking, i.e., a bud and two leaves plucked on a 9-10 day round. An area of six acres under Kent's Arabica coffee has also shown good growth and the bushes commenced to fruit at about 26 months from planting. The trees on a small experimental area of *Cinchona Ledgeriana* and *C. succirubra* continue to make satisfactory progress and are now beginning to produce seed in small quantities. Samples of bark of both species sent to the Government Quinologist, Bengal, India, for analysis elicited favourable reports on the alkaloidal content in each case.

Labour.—There is now an adequate supply of Tamil labour available for all works. The health of the labour force was most satisfactory throughout the year.

EXPERIMENTAL WORK.

Oil Palms.—With a view to investigating the manurial requirements of oil palms a scheme of manurial experiments is being carried out at Serdang on an area of two acres of oil palms in Block 21. As a result of preliminary observations of yield taken over a period of 1½ years it was decided to divide the area under experiment into 12 plots of 10 palms each. The scheme provides for three different forms of manurial treatment and an unmanured control, which allows of three replications of the experiment. It was decided in the first instance to apply quick-acting manures divided into two applications at intervals of six months, namely, in July to August and January to February. The first application of manures was made early in August and weekly records of the individual yield of the palms in each plot are now being taken in order to test the effect of the various manures on the yield of the palms under experiment compared with the untreated controls.

The results of an experiment in the artificial pollination of oil palms growing under field conditions on an area of approximately 20 acres in Block 5D, which has been in progress since January, 1926, have been summarised for publication in the

Malayan Agricultural Journal. The results of this experiment show that the palms pollinated artificially gave an average increase of 103.9 per cent. over the unpollinated controls taken over a period of approximately four years, which clearly indicates the necessity for artifical pollination in the case of young palms. It is intended to continue the experiment in order to ascertain whether this large increase in yield, due to artificial pollination, is maintained as the palms increase in age.

Experiments have been carried out at Serdang in the crossing and "selfing" of ten of the highest-yielding palms growing under avenue conditions with the result that to-date 69 distinct crosses and 4 "selfs" have been successfully established from known parentage. Half-acre plots of 28 crosses were planted up in Blocks 10A, 17, and 18 during October to November, 1930, in order to ascertain whether the high-yielding characters of the parents, grown under avenue conditions, are maintained in the progeny when grown under normal plantation conditions. Control palms, produced under ordinary estate conditions, have been planted between every four rows of the selected palms for purposes of comparison when the palms come into bearing. Further, individual records of yield have been made of the palms from which the various crosses have been produced since they commenced to fruit in August, 1924, and these records are being continued.

TEA.—Considerable attention has been given to the experimental cultivation of tea at Serdang and the total area under this crop is now approximately 30 acres. The whole area was carefully pruned during September to October and systematically manured. Immediately after pruning was completed, the mature area was manured with a "pruning mixture" and the immature areas with a "new clearing mixture".

A further supply of tea seed was received from Assam at the close of the year and this will be utilised for increasing the area under tea experiments.

An experimental tea factory is now being erected on the plantation and will be completed early next year. This factory, which is designed on the Ceylon type of building, is to be equipped with modern tea machinery capable of dealing with an output of approximately 60,000 lbs. of made tea per annum. In addition to carrying out experiments in the manufacture of tea on the plains in this country it is considered that this experimental factory will prove of great value in demonstrating the methods of manufacturing tea as commonly practised in Ceylon and Southern India.

PINEAPPLES.—An area of five acres of land has been enclosed with wire fencing for the purpose of carrying out various experiments in the cultivation and manuring of pineapples. A comprehensive scheme of experiments has been included in the general layout of this area with a view to testing (*a*) methods of cultivation, (*b*) different distances of planting, (*c*) effect of manuring on yield and quality of fruit, (*d*) varietal trials and (*e*) selection work on local and introduced pines.

STOCK FARM.—Considerable progress has been made in the development of the experimental stock farm at Serdang, six pure-bred Friesian incalf heifers were imported from Australia last June. Unfortunately these animals developed Red Water Fever (Piroplasmosis) shortly after arrival and one of the heifers died as a result of this disease, which is particularly virulent among imported European stock. The native Montgomery cattle although housed in the same cow-shed as the Friesians have proved to be immune to this dangerous disease. A cement-concrete cattle dip was constructed on the plantation at the end of the year so that it will be possible to dip all the animals regularly in future with a view to controlling ticks.

The herd of Large Black and Middle White pigs has proved most successful and quite a number of young boars and sows of both breeds have been distributed to different parts of the country for breeding purposes. It is impossible at present to satisfy the demand for young stock and orders are frequently given in advance for the Middle Whites, which are more popular than the Large Blacks. Two local Poland-China gilts were served by the Middle White and Large Black boars respectively.

The stock on the farm at the close of the year was as follows:

Cattle—

Montgomerys—Two stud bulls, eleven cows, five bull calves and six heifer calves.

Friesians—Two stud bulls, five cows, two bull calves and two heifer calves.

Ayrshires—Two heifers.

Jersey—One stud bull (on loan).

Pigs—

Large Black—Two mature and five immature boars, two sows and four gilts.

Middle White—One immature boar, one sow and two gilts.

Poland-China (local)—Two gilts.

Chinese Black (local)—Two gilts.

Cross-bred—Four gilts.

Manuring Experiments on Estates.—Arrangements were completed during July for the manuring of the various oil palm plots on both Tennamaram and Elmina Estates in connection with the departmental scheme of manuring for oil palms. Regular weekly visits are made to these estates and records of the yield of each individual palm have been taken since the inception of these experiments. A similar scheme was inaugurated for the manuring of coconuts in various parts of the country and the laying out of the numerous plots has now almost been completed.

General.—The senior members of the staff made numerous visits to estates throughout the country with a view to giving advice on a variety of agricultural problems requiring investigation.

Mr. B. Bunting, Agriculturist, visited Ceylon on special duty from the 20th January to the 16th February on his return from leave with a view to investigating the various methods employed in the cultivation of coconuts and the preparation of copra as practised in Ceylon. Mr. E. A. Curtler, Assistant Agriculturist, visited Ceylon, Southern India and Assam from the 18th April to the 24th October on special duty for the purpose of studying the cultivation and manufacture of tea as practised in those countries.

Nine articles were published in the *Malayan Agricultural Journal* by the Agricultural Division during the year, in addition to two Special Bulletins, General Series Nos. 1 and 2.

DIVISION OF AGRICULTURAL ECONOMICS.

The duties of the Agricultural Economist were revised at the beginning of the year under review. The duties of the division now include not only economic investigations, but the editing and management of all publications of the department.

The most important economic investigation concluded during the year was a Coconut Census of Malaya. The results of this census shew that there are over 600,000 acres of coconuts in Malaya, of which about three-quarters are mature palms. Holdings of under 100 acres each account for more than four-fifths of the total area under this crop.

Prices.—Commodity prices declined considerably. Cereals, oil seeds, oils and fats declined about 35 per cent. The fall in the prices of tropical agricultural products averaged 35 per cent. during the year, being about 50 per cent. below the 1914 levels.

Rubber prices fell to the lowest figure in the history of the industry. The average local price for first grade smoked sheet was 19.35 cents per lb. compared with 34.63 cents in 1929.

Copra prices declined less rapidly than rubber. The average Singapore prices for the year were: Sundried $7.80 per picul (133 1/3 lbs.); "Fair Merchantable", $7.45 per picul.

Palm oil prices shewed a decline from about £33 per ton to £16.10.0 per ton. The Malayan product, by reason of its purity and low free fatty acid content, usually commanded a premium of over £1 per ton.

Pineapples.—Prices of canned pineapples fell considerably, the lowest price towards the end of the year being around $3.30 per case, at which price it is doubtful whether canners can obtain a profit and it is certain that growers are unable to do so, as the price offered to them was around 80 cents per 100 fruits.

Arecanuts.—The decline in the prices of arecanuts was most felt during the latter half of the year, owing to the smaller demand from India.

Of other minor crops, which in the past have been of considerable importance in Malaya, may be mentioned tapioca, sago, gambier and nutmegs. Owing to the unsatisfactory prices for these products their cultivation continued to decline.

Publications.—(*a*) *The Malayan Agricultural Journal* was reorganised from the beginning of the year. Foreign subscriptions increased by 28 per cent. and local subscriptions by 152 per cent. The total circulation of the journal increased by 34 per cent.

(*b*) *Special Bulletins.*—Four Bulletins in the General Series and four in the Scientific Series were published in 1930.

(*c*) *Warta Perusaha-an Tanah* (Malay), Vol. VIII, was published in four quarterly parts. Two leaflets in Malay were also published.

(*d*) *The Chinese Agricultural Journal*, Vol. IV, of this publication was issued in four quarterly parts. Two leaflets in Chinese were also published during the year.

The total expenditure on publications amounted to $16,983.91, while revenue for the period was $8,917.

DIVISION OF CHEMISTRY.

Oil Palm.—A considerable number of routine samples from oil palm factories continue to be sent in for analysis. During the year 109 samples of palm oil were analysed for free fatty acid, moisture and dirt, and 30 samples of pericarp residue were analysed for oil content.

Research work on oil palm has been carried out along the lines of—

(*a*) recovery of residual oil from centrifugal pericarp by pressing or solvent extraction;
(*b*) the effect of pressure sterilisation of fruit upon the quality of kernels;
(*c*) the collection of data in connection with the bulk shipment of oil;
(*d*) methods of factory control;
(*e*) the removal of plant nutrients from the soil by the oil palm.

Oil Palm Factory, Government Experimental Plantation, Serdang.—The Oil Palm Factory at the Government Experimental Plantation, Serdang, commenced operation at the beginning of the year.

As a result of experiments and analyses carried out by the Chemical Division a standardised routine is followed in the factory, and samples for analysis, forming the basis of a factory control system are examined regularly.

A laboratory has been erected and equipped and is used by officers of this division and by the factory foreman for routine testing.

In connection with this oil palm factory 239 samples of palm oil have been examined for free fatty acid, moisture and dirt, and 38 samples of pericarp for oil content.

Tapioca.—Analyses of tapioca were continued and completed.

Rice.—Analyses of rice, in co-operation with the Economic Botanist, indicated that there were no marked chemical differences in the composition of various high yielding strains of padi.

During the last quarter a start has been made on the investigation of the relationship existing between the composition of rice and its manurial treatment, and the changes in composition which take place during growth.

Copra.—Copra research during 1930 dealt with a study of the quality of copra produced locally, the development of meat and oil in the growing nut, the optimum time for harvesting, the study of the phenomena attendant on drying, storage, baling and, in conjunction with the Division of Mycology, on mould attack.

Rubber Seeds.—Experiments on the storage of rubber seeds have been continued. The results show that in order to store rubber seeds satisfactorily, immediate sterilisation followed by thorough drying is necessary; even under these optimum conditions however the seeds will not keep for more than four months.

An experimental destructive distillation of rubber seed shell has been carried out. In comparison with wood distillation the yield of methyl alcohol and acetic acid was low, on the other hand, a good yield of an oil rich in phenols was obtained.

Miscellaneous.—A few miscellaneous analyses and experiments have been performed on the following plants:

(1) Gambier;
(2) Sisal;
(3) Tonka beans;
(4) *Gaultheria leucocarpa* (for oil of winter green);
(5) Jelutong.

DIVISION OF ECONOMIC BOTANY.

Titi Serong Experiment Station.—This station was well maintained, and towards the end of the year meteorological appliances were established which should provide regular records in 1931. The year under review was exceptionally dry—the rainfall being almost 18 inches less than the average, while the evaporation was nine inches higher than usual.

Selection Experiments were continued on the lines previously adopted. The most promising selections were planted in quadruplicated blocks for yield testing under field conditions at Titi Serong and in seven multiplication plots scattered over the Krian district. In addition to the best selections, a collection of foundation stocks, representing all the chief varieties of padi grown in Malaya, was maintained, and a few of the more promising of these varieties were multiplied for field trials.

Mixtures of the best four strains of each of the leading Krian varieties gave very good crops in the last harvest, and the same mixtures are under observation again this season and looked promising.

Hybridization.—Ten hybrids have grown very vigorously in the present season and may give very useful results, since they represent crosses between parents carrying most desirable characters.

Manurial Experiments on standardised lines are in progress near Titi Serong Station, and the padi shows good growth to date, but little variation is noticeable between the variously treated plots.

Seed Distribution.—An organized effort to distribute selected and tested seed on a cash basis was made in the poorer producing mukims of Krian and resulted in the sale of 5,400 gantangs of seed which may be considered fairly satisfactory. In addition to the above, over 4,200 gantangs of seed were distributed to other districts through Field Officers.

Training of Padi Inspectors.—Five Padi Inspectors completed a course of training at Titi Serong in 1930, and one is being trained this season.

Rice Storage Experiments.—A report, embodying data extending over two years, was completed during the year and showed that, given adequate protection from insect pests, storage under clean and dry conditions and with good ventilation, it is quite possible to keep rice in a satisfactory condition for periods up to two years.

Costs of Production of Padi.—A report dealing with this question was prepared for the Rice Cultivation Committee and showed that, locally, padi production costs $30 to $35 per acre.

Coconuts.—Individual palm fruiting records have been maintained for the 10th year from the experimental block of 10 acres at Carey Island where manurial experiments are now in progress. The manures were applied in July for the third time, and two years' results appear to indicate that an increase in crops can be derived from the application of certain manures, but conclusions are postponed until the results of the third year's application have been obtained.

Replanting.—On the same area an experiment in replanting is in progress. All the poor producing palms have been removed and their places supplied by seedlings derived from high-yielding palms. Growth of the supply palms, now two years old, has been fairly good but somewhat uneven, and their progress will be watched with interest. In this connection, it may be mentioned that, although 19 per cent. of the palms (poor) on the area were excised in 1928, there has been no appreciable diminution in crop from the area.

The Coconut Selection Experiment Station at Klang has been maintained in good condition. The growth of the palms is satisfactory and many palms are now forming fruit. Self and cross pollination experiments have produced fruits and some 40 seedlings have already been planted as a nucleus for a second generation of palms.

Meteorological records have been maintained at this station, and experiments in methods of preservation of pollen of various palms have been initiated.

Also records of the fruiting ability of dwarf palms have been continued in Parit Buntar.

Oil Palms.—Studies in variation of fruiting characters of 600 palms have been maintained at Elmina Estate, and some 400 fruit samples have been examined.

Soya Bean.—Twenty-eight strains of this bean are under observation for yield characters.

Trials at Kuala Lipis have given encouraging results, and trials are also in operation at Serdang and Klang.

Arecanuts.—Twenty local varieties, growing in a variety trial at Klang, show excellent growth and are now beginning to fruit. Records of the characteristics of each variety are being compiled.

Maize, Ground-nuts, Cotton, Etc.—Selections of these crops have been maintained under observation locally and at Klang. Eight hybrid strains of maize show exceptional vigour and field trials are being planned.

ENTOMOLOGICAL DIVISION.

Seven hundred and seventeen species of insects were forwarded for identification to and two hundred and forty-seven identified insects were received from the Imperial Institute of Entomology. Twelve species were described of which six were parasitic Hymenoptera.

Eleven papers were published and seven submitted for publication.

The principal investigations concerned, (*a*) *Tirathaba rufivena* Walk., (*b*) *Diatraea auricilia* Dudg. and *Schoenobius incertellus* Walk., (*c*) *Coccus* (*Lecanium*) *viridis* Green, and (*d*) *Stephanoderes hampei* Ferr.

Coconuts.—*Setora nitens* Walk.—a nettle caterpillar—was reported in considerable numbers in the Teluk Anson area towards the beginning and end of the year.

The investigation concerning the control and economic importance of the greater coconut spike moth (*Tirathaba rufivena* Walk.) was considerably advanced. The results shew that this insect is controlled by the removal of the sheath just before the spike would burst but the reduction in bored female flowers instead of going to increase the flowers (nuts) remaining augments the fall of flowers from other causes. This insect would appear to be of little (if any) economic importance on the two areas of dwarf coconuts where these experiments were conducted, and in future work it will probably be found of no importance to the coconut industry in general in Malaya. Four parasites of *Tirathaba rufivena* have been recorded in Malaya.

Nipah.—The Limacodid, *Parasa lepida* Cram., was troublesome on an area of nipah but control measures were effectively practised.

Towards the end of the year, the maggot of an Anthomyliid fly was found to be the cause of preventing, in some cases, the development and, in most cases, the full development of the female inflorescence. The maggot reaches the peduncle of the female inflorescence by way of the stalk of the male inflorescence. The removal of the male inflorescences has been demonstrated to be an effective as well as an economic control in so far that higher yields of nipah juice are considered to be obtained by artificially pollinating the female inflorescence.

Tea.—An entomological survey of most tea properties in Malaya has been made. No insects of significant importance have been found. The cut-worm (*Agrotis ypsilon* Rott.) was in evidence at Cameron's Highlands and the gryllid (*Brachytrypes achatinus* Stoll.) was responsible for some damage on two estates. *Heliopeltis* sp. (mosquito blight) caused minor injury and the aphid, *Toxoptera aurantii* Boyer., was also present in small numbers on one property.

Padi.—The attention of the entomological staff has largely been directed to the investigation of the control of the padi stem-borers, *Diatraea auricilia* Dudg. and *Schoenobius incertellus* Walk. by the egg parasite *Trichogramma nanum* Zehnt. which is being propagated on the eggs of the grain moth, *Sitotroga cerealella* Oliv. This work commenced in May, 1929, parasites being liberated over three small areas of padi during the 1929-1930 season. At the end of the season, observations and counts appeared to indicate that stem-borer damage was less in Colonised than in Uncolonised areas and to suggest that if liberations had begun earlier the influence of this parasite would have been more marked. For the 1930-1931 padi season a comprehensive programme was laid down. Liberations of parasites over nurseries were commenced in August and have been gradually increased. Fifteen million five hundred thousand parasitised eggs were distributed during December over the experimental area of 33 acres. To the end of December, an average percentage parasitism by *Trichogramma nanum* of the egg masses of *Diatraea* was 27.60 per cent. in the Colonised area as against 2.73 per cent. in the Uncolonised area, of *Schoenobius* 22.91 per cent. in the Colonised area as against 1.61 per cent. in the Uncolonised area. The parasitism of *Diatraea* egg masses on the 31st December, 1930, was 39 per cent. in the Colonised area and 6.25 per cent. in the Uncolonised area.

The Delphacid, *Sogata furcifera* Herv., and the Pentatomid, *Scotinophara coarctata* F. were not reported as causing such extensive damage as in previous years.

The caterpillars of the rice "worm" (*Spodoptera mauritia* Boisd.) caused temporary damage to padi in the field in most districts in Malaya. This is unusual, as this insect generally confines its attention to padi in the nurseries.

Coffee.—The coffee hawk moth (*Cephonodes hylas* L.) was reported prevalent in certain native properties in Selangor.

The investigation into the life-cycle and control of the green coffee scale [*Coccus* (*Lecanium*) *viridis* Green.] has been advanced. Parasites and heavy rains would appear to be responsible for the fact that this scale is not so important a pest in Malaya as in other countries.

The coffee berry beetle borer (*Stephanoderes hampei* Ferr.) has been recorded from other areas in Malaya. Weekly collections of coffee berries have been examined since May to ascertain if by regular and frequent collections this insect would eventually be controlled. The figures indicate that where the damage is heavy regular and frequent collections are not entirely satisfactory. In an extensive survey of coffee areas *Stephanoderes* was most abundant where coffee had been abandoned but conspicuously less where collections had been systematically performed.

Oil Palm.—Reports of serious injury have not been received. A caterpillar (*Tirathaba* sp.) damaging the pericarp and sometimes boring into the kernels of the fruits was recorded from one property on two occasions.

General.—The presence of the Locust, *Locusta migratoria* L., was reported on the 17th May in an area of "lallang" grass about two miles north of the 7th mile, Tampin-Gemas Road. The specimens were in the form intermediate between the solitary and swarming phases, phase *transiens*, and probably tending towards the swarming phase. This locust has not been received since June and its disappearance may be ascribed to the breaking-up of incipient swarms by poison bait and fires. Dipterous parasites were, however, obtained from adults.

INSTRUCTION DIVISION.

There were 23 Malay apprentices in training at the beginning of the year, of whom 16 were derived from the Federated Malay States, two from the Straits Settlements and five from the Unfederated Malay States; of these 10 were taking the first and 13th second years' course.

As the three years' course of training was introduced during the year no apprentices were available to fill existing vacancies and following the annual examinations held during April, 10 second-year students were promoted to the third years' course and 11 second-year students to the final year of training. Two second-year apprentices were dismissed for unsatisfactory progress.

During the absence of the Agricultural Instructor on long leave his lectures were delivered by members of the various departmental divisions.

Health and discipline were satisfactory throughout the year.

A short refresher course attended by 21 Malay officers was organised and held during the month of May.

The foundation stone of the School of Agriculture at Serdang was laid on the 19th March by H.H. The Sultan of Selangor.

Considerable progress in the erection of the school and hostel was made during the year. The buildings being practically completed towards the end of November, the installation of furniture was commenced.

An area of approximately 14 acres attached to the school was planted up with rubber and coconuts during the year; as much as possible of the practical work being carried out by the students. A nursery of budded stumps for multiplication purposes has been established, and an adequate supply of seedlings for nursery buddings, and practical bud grafting for students is being raised.

A text book entitled "Principles of Tropical Agriculture" written by Dr. H. A. Tempany and Mr. G. E. Mann, was published under the auspices of the Incorporated Society of Planters in May.

The majority of apprentices continued their service in the Selangor Malayan Volunteer Infantry and attended the annual camp at Port Dickson.

MYCOLOGICAL DIVISION.

Mycological research was principally concerned with a disease of the oil palm which was becoming serious on one estate. The disease takes the form of a rot of the stem ending in death of affected palms. A fungus allied to *Fomes pachyphlocus* Pat. is associated with the disease. Satisfactory preventive and control measures have been worked out. The disease has been found on most of the other estates where the palms are over six years old, but the percentage of infection is not at present serious.

Observations were made on the effect of *Thielaviopsis paradoxa* on the stem and leaf tissue of oil palms.

Records were made of what appears to be an after effect of lightning strike on coconut palms. Some months after the strike some of the apparently healthy palms on the edge of the affected area began to bleed from the stem. Small boring beetles attacked the palms and caused the bleeding.

Work on moulds on local copra was begun in October to investigate their association, if any, with the deterioration of the product and decrease in oil content.

Studies of soil micro-flora were continued and records made of the growth and virulence of the root nodule organism *Bacillus radicicola*, isolated from *Dolichos Hosei* and *Calopogonium muconoides*.

Mr. Altson was occupied from September in the production of a propaganda film on rice.

Six articles were contributed to the *Malayan Agricultural Journal* and a special bulletin on Panama disease of bananas was issued during the year.

Other diseases dealt with included those of tea, coffee, vanilla, pepper, bananas. brinjals, tomatoes and flowering plants.

DIVISION OF SOILS AND PLANT PHYSIOLOGY.

The work of the division continued to be on soils or problems immediately connected therewith.

Soil Survey.—The survey of the coastal soils has proceeded throughout the year. Differentiation of the alluvials has proved to be a far more difficult problem than that of the inland soils owing to the fact that, whatever their original source, their subsequent conditions have been closely identical. This has rendered it imperative that the survey should be carried out over a much larger area than was at first thought to be necessary.

Certain facts of economic importance have been brought to light during the year. Amongst these are the presence of an extensive peat belt between the coastal soils proper and the inland formations. This was more or less predicted in the first place from observations made in Central Selangor, and has been amply confirmed from as far north as Tapah and as far south as the Negri Sembilan border. In many cases the incidence of this belt has been disturbed by agricultural operations.

A second point that has been observed is the deleterious effect on many crops growing on alluvial soil of the presence of large quantities of fine sand. Whether this is purely a drainage question or a directly toxic affect is still under observation.

Pahang Volcanic Survey.—With the active co-operation of the Geological Department it was possible during the middle of the year to make a detailed survey of soils of the Pahang Volcanic Series around Jerantut. The soils present a number of interesting characteristics amongst which is the probability that they are considerably more fertile (from their chemical composition) than the general run of inland soils.

Routine Analyses.—There was a considerable decrease in examination of soils from proposed oil palm areas, but a striking increase in the number of coconut soils examined for the general public, a reflection on the considerable interest now being taken in the maintenance in an economic condition of old coconut areas on coastal soils—two dry years have possibly accentuated poor conditions.

Soil Atmosphere.—A considerable amount of time during the latter half of the year has been devoted to work on this problem.

Moisture under Cover Crops.—A long series of observations was made under this head at Serdang during the year and a report was published in the *Malayan Agricultural Journal* for October, 1930.

From the observations made it seems legitimate to conclude that no fear need be entertained of harmful effects even on young crops of covers on the score of reduction of soil mosture content.

STATISTICS DIVISION.

It was decided by Government that a Statistical Division for Agricultural Statistics should be organised in the department.

With that end in view Mr. Gordon-Carrie, Deputy Registrar-General of Statistics, Straits Settlements and Federated Malay States, was seconded to the department as Statistician, with effect from 1st January, 1930.

Early in the year a visit was paid to Kedah. The visit was productive of much useful progress towards the desirable goal of bringing Kedah statistical work closely into line with that done in the Federated Malay States and the Straits Settlements. The Government of Kedah very kindly handed over the records collected during restriction of rubber exports and these were made the basework of tables which enabled the department to provide material for new rubber statistics relating to Kedah.

Efforts were early directed to improve the statistics which related to padi. Very close co-operation was given by the Field Staff and during the year constant revisions took place resulting in satisfactory figures being obtained as regards the area of land devoted to the cultivation of padi.

Unfortunately the statistics relating to yields, or crops of padi harvested, proved to be most unreliable. In view of its great importance economically the question was raised at the Agricultural Conference. From the discussion at that conference it was decided to try out new methods. It is hoped that the next year's estimates, so arrived at, will prove far more accurate than any previously obtained.

Work has been done in connection with coconuts and with oil-palms and a system for regular returns as to areas planted and yields has been formulated.

The so-called minor crops, e.g., tapioca, arecanuts, pineapples have not been overlooked, but owing to the fact that in most cases such crops are planted as "Catch Crops" complete accuracy of any returns relating to them is difficult or impracticable to attain. The returns of such crops depend almost wholly upon information gathered by the Field Officers of the Department of Agriculture.

Some time has been spent in inspection work with a view to ascertaining the conditions on small rubber holdings.

The question of bark renewal and the conditions of the holdings generally is very closely connected with the statistics of the total yield of the small holdings. A preliminary report was submitted some time ago and a final one giving more information is now being prepared. Further work is being done by the Rubber Research Institute and officers of the Department of Agriculture.

Towards the end of the year revised statistics giving for the first time information relating to rubber in the whole of Malaya were made available and were published under one cover by the Department of Statistics.

Arrangements have been made to ask all rubber estates of 100 acres or over to declare any catch-crops planted or harvested monthly. It is hoped this will enable fuller knowledge to be made available. Steps are being taken to get full information regarding factories for the extraction of palm oil.

There is no doubt that the close co-operation established with the Governments of the Unfederated Malay States has been most valuable in enabling the compilation of far more complete statistics relating to rubber than those available before and there is every reason to anticipate with confidence equally good results in respect of other crops.

H. A. TEMPANY,
Director of Agriculture, S.S. & F.M.S.

KUALA LUMPUR,
27th April, 1931.

APPENDIX A.

STAFF.

	Director of Agriculture ...	H. A. Tempany, D.Sc., F.I.C., F.C.S.
Agriculture ...	Agriculturist	B. Bunting, N.D.A., F.L.S.
	Assistant Agriculturists ...	J. N. Milsum, F.L.S.
		E. A. Curtler, M.A., Cam. Dip. Agr.
		T. D. Marsh, N.D.A.
		J. Lambourne
		J. L. Greig, B.Sc., B.Sc. (Agr.)
	Horticultural Assistants ...	H. Ritchings
		F. S. Banfield, F.L.S.
		C. M. Maggs, Dip. Hort. (Reading), F.R.H.S.
	Agriculturist (Rubber) ...	F. G. Spring, N.D.A., U.D.A., F.L.S. (Seconded to Co-operative Societies Dept.)
Chemistry ...	Agricultural Chemist	B. J. Eaton, O.B.E., F.I.C., F.C.S., F.I.R.I. (Seconded to the Rubber Research Institute)
	Acting Agricultural Chemist	C. D. V. Georgi, O.B.E., B.Sc., F.I.C.
	Asst. Agricultural Chemists ...	V. R. Greenstreet, A.I.C.
		R. G. H. Wilshaw, B.A., B.Sc., A.I.C.T.A.
	Assistant Chemist for Copra Investigations	F. C. Cooke, A.R.C.S., B.Sc., A.M.I.CHEM.E.
	Assistant Analyst	Gunn Lay Teik, B.A.
Economics	Agriculture Economist ...	D. H. Grist, Cam. Dip. Agr.
Economic Botany	Economic Botanist	H. W. Jack, M.B.E., D.Sc., B.A.
	Assistant Economic Batanists	R. B. Jagoe, B.Sc.
		B. A. Lowe, M.A., Cam. Dip. Agr.
Entomology ...	Entomologist	G. H. Corbett, B.Sc.
	Assistant Entomologists ...	N. C. E. Miller, F.E.S.
		H. T. Pagden, M.A.
Field	Chief Field Officer	F. W. South, M.A.
	Agricultural Field Officers—	
	Province Wellesley and Penang	J. Fairweather, N.D.A., U.D.A.
	Perak North	F. Birkinshaw
	Perak Central	H. D. Leighton, C.D.A.
	Perak South	N. J. Simpson, B.Sc. (Agr.) Dip. Agr. Wye.
	Selangor	A. E. Coleman-Doscas, Dip. Agr. W.A.
	Negri Sembilan	W. H. Barnes
	Pahang West	R. G. Heath, B.Sc. (Agr.)
	Pahang East	J. M. Howlett, M.C., B.A., Cam. Dip. Agr. (on leave)
	Malacca	C. L. Newman, B.Sc. (Agr.)
	Singapore	J. W. Jolly, Dip. Agri. (Hawkesbury)
	(On leave)	F. R. Mason, Dip. Agr. (H.A.A.C.)

APPENDIX A—(*cont.*)

STAFF—(*cont.*)

Field—(*cont.*)		
	Principal Agricultural Field Officers—	
	Kedah	W. N. Sands, F.L.S.
	Johore	F. de la Mare Norris, B.Sc.
	Kelantan	J. A. Craig, N.D.A., C.D.A., A.I.C.T.A.
Library	Librarian and Translator ...	L. A. J. Rijk
Mycology	Mycologist	A. Sharples, A.R.C.S., D.I.C. (Seconded to the Rubber Research Institute)
	Assistant Mycologists ...	A. Thompson, B.Sc.
		R. A. Altson, B.Sc., A.R.C.S.
		F. S. Ward, B.S.A. (McGill)
School of Agriculture, Malaya ...	Vice-Principal	G. E. Mann, M.C., M.A.
	Senior Lecturer	V. Dawson, B.Sc. (McGill)
	Junior Lecturer	Raja Mahmud bin Raja Ali
Soils and Plant Physiology ...	Plant Physiologist	W. N. C. Belgrave, B.A., Cam. Dip. Agr.
	Assistant Chemist	J. H. Dennett, B.Sc.
Statistics	Statistician	J. Gordon-Carrie, B.Sc.

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